

Road Weather Management Program

Paul Pisano

Team Leader, Road Weather & Work Zones, FHWA

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Madison, Wisconsin

Contact: paul.pisano@dot.gov, 202-366-1301



Topics

- Revisit the impacts
- High level roadmap
- Results since the last meeting
- Immediate plans
- Budget / MAP-21



Weather Impacts on Safety

Annual average from 1995-2008

Road Weather Conditions	Crashes	Injuries	Fatalities
Wet Pavement	1,128,000	507,900	5,500
Rain	707,000	330,200	3,300
Snow/Sleet	225,000	70,900	870
Icy Pavement	190,100	62,700	680
Snow/Slushy Pavement	168,300	47,700	620
Fog	38,000	15,600	600
Total Attributable to Weather*	1,511,200	629,300	7,130

*The sum of the crashes under each road weather condition does not equal the total number attributable to weather; crashes may be double counted, e.g. wet pavement and rain.

Source: http://www.ops.fhwa.dot.gov/weather/q1_roadimpact.htm



Weather Impacts on Mobility

Weather Conditions	Freeway Traffic Flow Reductions		
	Average Speed	Volume	Capacity
Light Rain/Snow	3% - 13%	5% - 10%	4% - 11%
Heavy Rain	3% - 16%	14%	10% - 30%
Heavy Snow	5% - 40%	30% - 44%	12% - 27%
Low Visibility	10% - 12%	-	12%

- On signalized arterial routes, speed reductions can range from 10% - 25% on wet pavement and from 30% - 40% with snowy or slushy pavement

Source: http://www.ops.fhwa.dot.gov/weather/q1_roadimpact.htm



Weather Impacts on Productivity

- Adverse weather can increase operating and maintenance costs of:
 - winter road maintenance agencies
 - traffic management agencies
 - emergency management agencies
 - law enforcement agencies
 - commercial vehicle operators (CVOs)
- Each year CVOs lose an estimated \$32.6B vehicle hours due to weather-related congestion in 281 of nation's metropolitan areas
- Nearly 12% of total estimated truck delay is due to weather in the 20 cities with the greatest volume of truck traffic
- Estimated cost of weather-related delay to trucking companies ranges from \$2.2B to \$3.5B annually

Source: http://www.ops.fhwa.dot.gov/weather/q1_roadimpact.htm



High Level Roadmap

Focus Areas		Activities	Objectives
Stakeholder Coordination		Lots of interesting projects	Build partnerships
Program & Performance Management			Ensure investments pay off
R&D	RdWx Data Capture & Mgmt		Transportation & weather communities use fixed and mobile observations
	RdWx Dynamic Applications		Integrate RdWx observations into advanced decision support tools
	Weather-responsive Traffic Mgmt		Advance the state-of-the-practice through tailored management strategies
Tech Transfer, Training, Education			Raise road weather capabilities across the industry
Operations & Climate Change			Operations is engaged with climate change community



Results Since Last Meeting

Aurora and Clear Roads Pooled-Fund Studies	
Research Accomplishments	<ul style="list-style-type: none"> ✓ The Aurora and Clear Roads pooled fund studies continue to do excellent work. ✓ A WiKi Tool has been developed by the consortium members and is being populated. The tool focuses on maintenance management best practices.
Critical Research Insights	<ul style="list-style-type: none"> ➡ Numerous studies have been completed, and many recommendations have been implemented as a result. ➡ State and local agencies continue to need research support in resolving critical road-weather transportation problems. Many states are willing to partner with the Federal government in conducting the research and are willing to be lead-adopters of new technologies.
Next Steps	<ul style="list-style-type: none"> • Continue to prioritize Research Needs Statements for funding as well as to conduct technology-transfer efforts within the stakeholder community. • Continue to populate the Wiki webpage.



Results Since Last Meeting (cont.)

Stakeholder Outreach	
Research Accomplishments	<ul style="list-style-type: none"> ✓ To publicize the research results and engage stakeholders, the RWM program held the first national workshop and stakeholder meeting on WRTM on October 6 and 7, 2011, in Portland, Oregon. Participants included representatives from FHWA, 26 state DOTs, 2 city agencies, and 1 turnpike authority, along with several private contractors and researchers.
Critical Research Insights	<ul style="list-style-type: none"> ➔ Improve understanding of how travelers behave in response to information during weather events ➔ Continue to improve monitoring and coordination for weather events ➔ Bring partners together for WRTM ➔ Address legal, institutional and regulatory challenges ➔ Educate and manage expectations of travelers during weather events ➔ Measure WRTM performance ➔ Address gaps through analysis and modeling ➔ Share technical knowledge and success stories among the stakeholder community
Next Steps	<ul style="list-style-type: none"> • Conduct research to follow up on the critical research insights



Results Since Last Meeting (cont.)

Road Weather Technology Deployment Data-Mining and Analysis	
Research Accomplishments	<ul style="list-style-type: none">✓ The 2010 ITS Deployment Survey gathered information about the extent of deployment of ITS technology for RWM across different transportation agencies.✓ The survey was divided into seven agency types, two of which were selected for analysis: the Arterial Management Survey and the Freeway Management Survey.
Critical Research Insights	<ul style="list-style-type: none">➡ The analysis revealed that RWM strategies vary on the basis of the functions of the transportation agency; this will help to identify ways to frame future programs that promote the use of ITS technology for RWM as well as areas for additional data collection.
Next Steps	<ul style="list-style-type: none">• No further steps are planned.



Results Since Last Meeting (cont.)

Data Capture and Management	
Research Accomplishments	<ul style="list-style-type: none"> ✓ The RWM program is currently developing a Vehicle Data Translator (VDT), which processes vehicle probe data and turns it into useable weather and road condition observations. ✓ Output data from the vehicles, whether directly or via VDT, is being incorporated into a variety of weather-related decision-support tools and management systems. ✓ The RWM program is partnering with the DOTs of Minnesota and Nevada to incorporate data collected from their mobile fleets into the VDT and <i>Clarus</i> and ultimately into one of these advanced decision-support and/or management systems.
Critical Research Insights	<ul style="list-style-type: none"> ⇒ In Minnesota, approximately 80 state DOT snowplows are collecting information from onboard sensors and incorporating it into their management system. This information is used to generate an End-of-Shift Report that summarizes such variables as the amount and type of materials dispensed by the snowplows as well as where and when the vehicles traveled. ⇒ In Nevada, the mobile data (engine fault codes) will eventually be integrated into the fleet maintenance management system to generate reports that flag potential problems with the vehicles while they are on the road and alert the appropriate personnel to take necessary measures. The intent is to prevent costly vehicle breakdowns.
Next Steps	<ul style="list-style-type: none"> • An enhanced version of the VDT (VDT 3.0) with improved algorithms will be completed in September 2012. • The RWM program plans to expand its work on the VDT and weather-related applications, perhaps working with other states and datasets.



Results Since Last Meeting (cont.)

Data Capture and Management - The <i>Clarus</i> Initiative	
Research Accomplishments	<ul style="list-style-type: none"> ✓ <i>Clarus</i> is an ITS research and development initiative, aimed at improving the accuracy and timeliness of road weather information made available to road users and operators and at building the road weather observational database that supports the development of "anytime, anywhere road weather information."
Critical Research Insights	<ul style="list-style-type: none"> ⇒ Thirty-nine state DOTs, five local agencies, and four Canadian provinces have connected 2,435 environmental sensor stations (ESS) to Clarus, for a total of 54,195 individual sensors. ⇒ Findings confirmed the value of ESS observations in Road Weather Forecast Systems and the benefits of decision-support systems that use these forecasts over standard atmospheric forecasts. ⇒ Funding was also provided to eight additional projects that made use of the Clarus data in innovative ways.
Next Steps	<ul style="list-style-type: none"> • Build upon the decision support tools created under the regional demonstrations as the basis for connected vehicle road weather applications. • FHWA continues to work very closely with the National Oceanic and Atmospheric Administration (NOAA) to transition the Clarus system to operational status under NOAA.



Results Since Last Meeting (cont.)

Road Weather Connected Vehicle Applications	
Research Accomplishments	✓ A draft ConOps has been completed and is under review. The ConOps describes the six priority applications. With these descriptions, a set of functional and data requirements will be developed. The ConOps is expected to be available in late summer of 2012.
Critical Research Insights	➡ The ConOps contains a number of scenarios that are based on stakeholder input. These scenarios assisted with the identification of technical and institutional constraints as well as potential operational impacts.
Next Steps	<ul style="list-style-type: none"> • Development of functional and data requirements, due in fall of 2012. • Outreach to vehicle and device manufacturers to analyze whether the data sets can be made available. • Outreach to implementing stakeholders to confirm and vet the scenarios.



Results Since Last Meeting (cont.)

Weather and Traffic Analysis: Incorporating Weather Impacts in Traffic Estimation and Prediction Systems (TrEPS)	
Research Accomplishments	<ul style="list-style-type: none"> ✓ The RWM program has developed new models to determine how pre-trip and en-route weather information affects travel demands and traffic flows, and is incorporating this knowledge into dynamic traffic assignment and prediction models, such as the leading-edge DynaSMART and DynaMIT ✓ Work is currently underway to test and evaluate weather-responsive TrEPS in Salt Lake City, New York City, and possibly Chicago. ✓ Transportation networks in Salt Lake City, New York City, and Chicago have been calibrated for the TrEPS model. Site visits were made and discussions held to identify traffic management strategies that will be analyzed.
Critical Research Insights	<ul style="list-style-type: none"> ⇒ Existing TrEPS models (both offline and real-time) do not account for varying traffic conditions due to weather and cannot evaluate the effectiveness of traffic management strategies designed to alleviate weather impacts. Calibration of transportation networks for weather-sensitive dynamic traffic assignment, however, creates the ability for weather impacts to be incorporated in the DynaSMART traffic estimation and prediction system models. ⇒ Implementation and evaluation of the TrEPS model will demonstrate not only the ability to improve traffic estimation and prediction during weather events but also the applicability of these models in day-to-day traffic operations. An important conclusion is that the availability of real-time weather and traffic data is widely needed to make this happen.
Next Steps	<ul style="list-style-type: none"> • Test and evaluate the weather-sensitive TrEPS models in those cities with and without traffic management strategies.



Results Since Last Meeting (cont.)

Developments in Weather-Responsive Traffic Management Strategies	
Research Accomplishments	<ul style="list-style-type: none"> ✓ The RWM program has documented the state-of-the-practice in weather-responsive traffic management (WRTM) and identified improvements to WRTM strategies. These operational improvements include such traffic management staples as active traffic and demand management, traffic signal management, and traveler information. ✓ The RWM program has conducted a series of webinars to highlight the findings to date. <ul style="list-style-type: none"> • Webinar 1: Weather Responsive Traffic Management using ATM Strategies: Setting the Stage (March 20, 2012) • Webinar 2: Use of Social Media during Weather Events (April 19, 2012) • Webinar 3: Weather Responsive Traffic Signal Management (May 31, 2012)
Critical Research Insights	<ul style="list-style-type: none"> ➡ Research has revealed the best ways to execute WRTM strategies under adverse weather conditions.
Next Steps	<ul style="list-style-type: none"> • Work is underway to conduct field tests and evaluate some of the management strategies that were identified.



Results Since Last Meeting (cont.)

Weather and Traffic Analysis: Human Factors	
Research Accomplishments	✓ The RWM program has conducted research to examine the human factors involved in road weather advisory and control information. Given the amount of available weather information and the methods of dissemination, the study looked at the content and the methods for presenting the information to travelers in a way that it is useful to them.
Critical Research Insights	➡ Guidelines were developed for length of messages, message structure, and message wording, resulting in safer strategies for providing weather information to travelers.
Next Steps	• Follow-up work is underway to test and evaluate those guidelines.



Results Since Last Meeting (cont.)

Road Weather Management Best Practices	
Research Accomplishments	<ul style="list-style-type: none"> ✓ The database has been updated to reflect the latest advancements in RWM. ✓ The effort is documenting solutions deployed by state DOTs, capturing a range of advisory, control, and treatment actions, which will help to improve roadway operations under inclement weather conditions.
Critical Research Insights	<ul style="list-style-type: none"> ⇒ More than 25 states have been interviewed regarding their RWM best practices. New information has been appropriately documented.
Next Steps	<ul style="list-style-type: none"> • A new report will be published and the older information will be archived.



Results Since Last Meeting (cont.)

Web-Based Training Course on Weather-Responsive Traffic Management

Research Accomplishments	✓ A blended web-based course on WRTM is being developed through the University of Maryland CITE (Consortium for ITS Training and Education) program. The course will help traffic managers and practitioners to identify and implement proactive WRTM strategies and evaluate their effectiveness.
Critical Research Insights	➡ The course modules were identified and a general outline was developed.
Next Steps	• Develop the course contents and conduct the pilot.



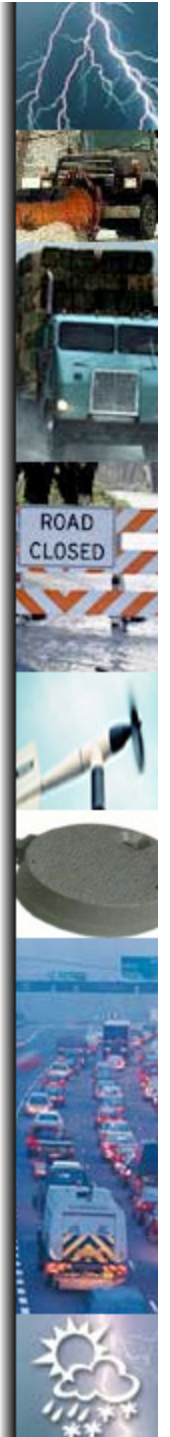
Results Since Last Meeting (cont.)

Operations & Climate Change	
Research Accomplishments	<ul style="list-style-type: none"> ✓ Helped define operations and maintenance aspects of sustainability <ul style="list-style-type: none"> • Focused on snow and ice control • Captured in an online tool (INVEST) http://sustainablehighways.org ✓ National Earth Observing Assessment <ul style="list-style-type: none"> • Provided DOT input to a broader effort to capture observing system needs
Critical Research Insights	<ul style="list-style-type: none"> ➡ Better understanding of potential impacts of climate change on Operations & Maintenance ➡ Knowledge gaps
Next Steps	<ul style="list-style-type: none"> • Identify R&D needs and explore how climate change could be incorporated into O&M practices • Determine weather observing needs for the transportation community



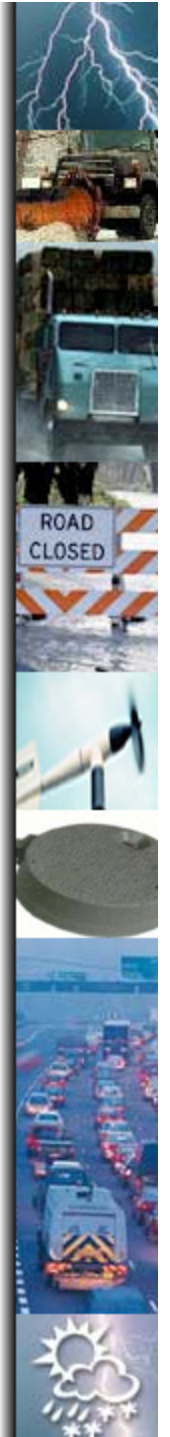
Immediate Plans

- Coordinate & provide technical support to broader Connected Vehicle Program (esp. DCM & DMA)
- Post VDT 3.0 on the Open System/Open Source Portal
- Initiate VDT 4.0 development
- Execute initial phase of the *Clarus* transition to NOAA
- Execute tire research project (e.g., friction)
- Initiate development of the WxDE (Weather Data Environment)
- Award 2nd phase of the State DOT/Connected Vehicle applications
- Participate in NTCIP 1204 updating/amending
- RdWx Connected Vehicle applications development
- Complete Wx/TrEPS testing and evaluation
- Initiate Wx/TrEPS implementation
- Complete analysis of mobile data applications for WRTM
- Complete development of advanced WRTM strategies, and prepare for evaluation
- Explore the link between Emergency Transportation Operations & adverse weather
- Develop weather modules for highway capacity and travel time reliability analysis (with SHRP2)
- Initiate task for road weather message guideline implementation
- Complete the 2012 update to RWM performance measures
- Support implementation of the 1201 rule
- Complete development of the Weather-responsive Traffic Management course
- Stakeholder engagement - reach out to 50 public agencies + others (via RWM meeting, offer course(s), promote TMC integration, participate in pooled fund studies, etc.)
- Promote the findings, products and other output material from the RWM Program via the RWM website, webinars, and other outreach media



Budget / MAP-21

- We have enough funds to carry out our research agenda in FY2013
- MAP-21 didn't reauthorize the Road Weather R&D Program
- However, it recognizes the importance of road weather in several places
- Identified road weather management as a "Priority Area" under ITS R&D



Need Your Feedback

- What are we doing right?
- What are we doing that you think is unnecessary?
- What are we missing?

